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EARTH SEWAGE

• VERSUS

WATER SEWAGE

OR

NATIONAL HEALTH

AND

WEALTH

INSTEAD OF

DISEASE AND WASTE

BY

THE REV. HENRY MOULE, (ENGLAND)

EDITED

(UNDER THE DIRECTION AND SANCTION OF THE GOVERNMENT OF CANADA)

BY

E. A. MEREDITH, L.L.D.

UNDER SECRETARY OF STATE FOR THE PROVINCES;

MEMBER OF THE LATE BOARD OF INSPECTORS OF ASYLUMS, PRISONS, &c.

HONORARY MEMBER OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SOCIAL SCIENCE;

CORRESPONDING MEMBER OF THE NEW YORK PRISON ASSOCIATION, &c.

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OTTAWA:

PRINTED BY G. E. DESBARATS.

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" Cess-pools and Privy Vaults are unnatural abominations, treasure houses of bad  
" smells and noxious gases—Sources of disease and death."

MOULE.

Pulveris exigui jactu compressa quiescunt.

VIRGIL. (Georgics.)

« At a Congress on the utilization of sewage, held at Leamington,  
« (England), in October, 1866, Dr. Hawkesley, of London, read a  
« paper on the “Dry Earth System.”

« The deductions he drew, at the conclusion of his paper, were  
« that the refuse organic matter from any human community is of  
« immense amount, and of great value if well applied, but the source  
« of great, varied, and increasing evils to the public health if ill  
« applied, as well as a great drain on the resources of the wealth and  
the food of the people; that the present mode of dealing with the  
« sewage of towns fails to utilize it, but, on the other hand, so mixes  
« it up with the great essentials of life—the air we breathe and the  
« water we drink—as to lower the standard of vitality, produce much  
« disease, and convey epidemic poisons in the most fatal and wide  
« spread manner; that the present system is an error from the  
« beginning to the end, and incapable of any satisfactory improve-  
« ment; and that the method of employing agents for absorbing,  
« deodorizing, and utilizing the matter, according as he had described  
« and detailed it, affords a complete, practicable, and highly practical  
« mode of accomplishing all the objects of the sewage system.»



## P R E F A C E.

In December last year the Governor General received from the Colonial Secretary a Despatch inviting the attention of the Government of Canada to an improved system of Sewage recently introduced into England and known as *The Dry Earth System*.

The Colonial Secretary stated in his Despatch that «he understood that the system had been generally adopted in the Hospitals and Prisons of India,» and that it appeared to him «well deserving of consideration» not only in relation to Hospitals, Jails and Asylums, but also to «all other establishments in which considerable numbers of persons are brought together.»

The Despatch was accompanied by many interesting Letters and Reports from the Government of India—from several Sanitary Commissioners and other Public Officers of that Country in reference to the practical working of the new system of Sewage. All these official documents agreed in representing the system to be one of the most important sanitary and economic discoveries of the age. Dr. Mouat, the able Inspector General of Jails in the Presidency of Bengal, emphatically declaring «its introduction to be «the greatest public benefit conferred by a private individual that «he is acquainted with.»

The best evidence probably of the estimate of the value of Mr. Moule's labours formed by the Government of India will be found in the following extract from a letter addressed to the Rev. H. Moule, from the India Office in London, dated September 25, 1867.

«I am directed by Sir Stafford Northcote to forward for your «information copies of Reports which have now been received «from the Government of India, on the successful and general «adoption of your dry earth sewage system in India. In consideration of the very satisfactory character of these Reports, and «on the recommendation of the Government of India, the Secretary «of State for India in Council has much pleasure in authorizing «the payment to you of the sum of five hundred pounds.»

The Governor General kindly communicated to me, as Chairman of the Board of Inspectors of Prisons and Asylums, a copy of the



Despatch and Enclosures above referred to. While thanking His Excellency for these valuable documents I took occasion, on behalf of the Board, to inform him that so far back as the year 1862, my attention had been called to a pamphlet\* by the Rev. Mr. Moule, announcing his discovery of the Dry Earth System, and further that, recognizing the great value of the discovery, I in the course of that year brought the subject formally under the notice of my colleagues on the Board.

As an evidence that my colleagues had not only not failed to appreciate the bearings of this sanitary discovery, but that they had been at some pains to introduce the improved system into the Provincial Penitentiary and other Public Institutions of the Country, coming under their supervision, I quoted in my communication the following extracts from the published Report of the Board for the year 1866, under the caption «Dry Earth Closets.»

«The substitution of the “Dry Earth Closets” for “Water Closets” has for the last three or four years been going on very generally in many of the Jails and other Public Institutions, as also in many private residences in England.»

«Previous to the general adoption of this system in England, the authorities in India had recognized its value, and introduced it, in a very simple form, into all the Jails of that country. In their last Official Report the Indian Authorities pronounce the system as perfectly successful, and extremely simple.

«Judging from the highly important sanitary and economic results which have invariably followed the introduction of this system wherever tried, the Inspectors think themselves warranted in asserting that the “Dry Earth” system is destined to rank among the most valuable sanitary and economic discoveries of the day.

«Under these circumstances the Inspectors feel that they may be permitted to refer, with some degree of satisfaction, to the fact, that this Board was it is believed the first public Body on this Continent who officially called public attention to the subject, and took steps to test the efficacy of the new system by actual experiment, as they did, first in the Provincial Penitentiary, and afterwards in several of the Common Jails of the country.

«The Inspectors do not hesitate to predict that before many years are over the “Dry Earth” system, which it has fallen to their lot to inaugurate on this Continent, will be found in use gene-

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\* The Pamphlet was kindly placed in my hands by Col. Campbell, C. B. Seignior of St. Hilaire.



« rally, not only in the Jails and other Public Institutions of Canada,  
 « but also in the Public Institutions and private residences through-  
 « out the Continent.»

In the spring of the present year, His Excellency caused me to be furnished with various other documents procured at my suggestion from the Colonial Office, giving more detailed information as to the practical working of the improved system.

Before any opportunity presented itself of submitting the last mentioned documents to the then Board of Inspectors the Penitentiaries Act of the last Session of Canada having become law the Board of Inspectors ceased to exist, and with it terminated my Official connection with the Penal and Charitable Institutions of the country.

Though unable therefore to interpose officially in the matter, I ventured as « *Amicus Curie* » to submit to the consideration of the Secretary of State the despatches and other documents in my possession bearing on the new mode of sewage, and I, at the same time, suggested that the subject was of such paramount importance to society in general, both in a sanitary and economic aspect, as to warrant the Government in taking measures to give publicity to the discovery, with a view to encourage and facilitate the introduction of the new system, not only into the Jails Hospitals and Asylums of Canada ; but also into Barracks and other establishments where large numbers of persons are brought together.

I submitted that the most effectual means of disseminating the necessary information on the subject would be the publication and distribution, under the sanction and direction of the Government, of a short pamphlet setting forth the general nature and importance of the “ Dry Earth ” system, and the simplest means of carrying out the system in public institutions and elsewhere.

In support of this suggestion I mentioned that “ The Sanitary Commission at Calcutta ” had reprinted one of Mr. Moule’s papers, and sent it to every station throughout India, and further, that the Punjaub Government had translated the same paper and that in 1864 several of the higher class natives had adopted the system.

The suggestion met with the cordial approval of the Government, and, as I had given some little attention to the subject, the task of preparing the proposed pamphlet was entrusted to me.

The preceding remarks are intended to explain the origin and scope of the present publication, and to account for my editorial connection with it.

In discharging the task assigned to me by the Government, two courses were open to me ; either simply to reprint, without alteration, one of Mr. Moule's pamphlets already before the world, or to compile from the documents in my possession a *quasi* original treatise upon the subject. I have decided to take the former plan, not only as being the easier and simpler, but also as being the more fair and honest towards Mr. Moule. It seemed to me right that Mr. Moule should have an opportunity of submitting his discovery to the people of Canada in his own words and after his own fashion ; and that, from the first, his name should be associated with the introduction into the country of the great measure of sanitary and economic reform, which, influenced solely by a desire to benefit his fellow men, he has so ably, so earnestly, so perseveringly, and so successfully, laboured to bring about, and which has deservedly secured for him a place among the benefactors of his kind.

The pamphlet selected for publication is one written by Mr. Moule in 1866, for the express purpose, as he himself informs us, *of giving a fuller and more practical account* than had previously been given of the advantages and of the principles of the Dry Earth System, « of the application of those principles to individual cases, « and of the feasibility of its general adoption in villages and towns.»

The fact that the new system of sewage is one that can be so readily and advantageously adopted in our villages, towns and cities, is one which should command for it a willing and earnest attention in this Canada of ours. We need not go much beyond the Metropolis to be made painfully sensible of the fact that the system of sewage at present in use in some of our cities falls something short of absolute perfection.

The labour of the Editor, though comparatively easy, has not been merely nominal. Besides writing the explanatory notes appended to the pamphlet, the Editor has been at some pains to collect from various sources the matter contained in the Appendix. In it the Editor trusts there will be found useful practical information on many points of special importance necessarily noticed but briefly in Mr. Moule's short paper.

Should the following pages be the means of facilitating the introduction into Canada of the new system of sewage, the Editor will have the satisfaction of feeling that, through the liberal and enlightened action of the Government of Canada, he has been permitted to contribute somewhat to the promotion of a work of great

national importance, one to which, so far as he is aware, he was the first official person on this continent to draw public attention.

In this preface, Mr. Moule's Dry Earth System has been throughout spoken of as the *new* system. The expression is open to objection. Mr. Moule himself, in his Pamphlet on National Health and Wealth, informs us, «that the official reports from India prove that the *new* «method of deodorizing fæcal matter was early known to the «Hindoos, and further that it has been practised amongst the «Chinese in the south of China, from time immemorial.» It would seem indeed that the observance of a similar practice was enjoined by Moses upon the Israelites in the wilderness.\* Verily, there is nothing new under the Sun!

In concluding it may not be out of place to mention that partly in consequence of its being necessary to write to England for information on certain points, and partly from private reasons the publication of the present Pamphlet has been somewhat delayed.

E. A. MEREDITH,

Ottawa, October, 1868.

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\* See Deuteronomy, Chap. 23, vv. 12, 13.



## INTRODUCTION.

As the evils of the water system of sewage become daily more manifest, especially in the pollution of rivers, and in the increased burden of rates thrown by expensive public works on the industrial classes, the prejudice against the mode of removal of excrementitious and other offensive matters by means of Dry Earth seems greatly to abate. At all events, the inquiries on the subject are so frequent as to compel me to undertake this fuller and more practical statement than I have hitherto given, of the advantages of this system and of its principles; of the application of those principles in individual cases; and of the feasibility of its general adoption in villages and towns. And I do this now, not merely for the sake of England, *but of other countries*; amongst which, those perhaps will derive from the adoption of the system the greatest advantage, which are situated either within the tropics, *or in the more northerly latitudes*. It has already been introduced into all parts of British India and the Straits settlements. Many high class natives in the Punjaub have been induced to adopt it; and the able Inspector-General of Gaols in Bengal, who led to this by bringing to the notice of the Sanitary Committee in Calcutta a paper read by me before the Society of Arts in 1863, has, together with other medical officers, expressed his decided opinion that the benefits already apparent are such as to render it impossible to overestimate the advantages likely to arise to India, both as to comfort, health, and economy, through the adoption of this system.

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### I.—THE ADVANTAGES OF THE DRY EARTH SYSTEM.

The only other system with which this has to compete is that for removing excrementitious and other offensive matter by means of water. The advantages of the Dry Earth system, as compared with this, are as follow :—

1. In a sanitary point of view—the evil of foul and noxious smells and gases is not merely removed from the individual house into the public sewer, or brook, or stream, or cesspool, there to ferment and become far more injurious to others, and perhaps to the inhabitants of that very house; it is actually destroyed,\* injurious exhalations are prevented; fermentation and the escape of

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\* Water neither absorbs nor effectually deodorizes fæcal matter, dry earth both absorbs and deodorizes such matter and that almost instantaneously. [Ed.]



sulphuretted hydrogen are prevented; and the mixture of earth and excrement, unlike the mixture of water and excrement, is removed from the premises without the possibility of injury either to the occupiers of those premises or to the public.\*

2. The Dry Earth system is *admissible into sick rooms and into the wards of hospitals*; and through its admission one of the greatest miseries of human life, the foul smells of the sick room, and one of the most frequent means of communicating infection, may be entirely checked. Again, public urinals at railway stations and in our streets, instead of being the greatest nuisances, may be rendered completely inodorous. And other public conveniences, to the immense relief of human nature, may, by this means, be established, not only without any offence to the neighbourhood, but with pecuniary profit to the parties establishing and maintaining them.

Lastly, while this system obviates the contamination of well-water, quite as effectually as the water system can; it does not, as the water system invariably does, by expensive works entailing heavy rates and increased burden of rent, promote the overcrowding of houses and rooms, and the increase in this direction of the causes of sickness.

This points to the advantages of the DRY EARTH system in an economical point of view. No expensive public works are required for its adoption. A population of 7000 people would require, for the water system, an outlay on such works of at least 7000*l.*, to say nothing of the cost of the water-works. The private cost would be, I suppose, equal to this; and there is the lasting expense of water supply and repairs. The private works for such a population adopting the dry earth system, could scarcely exceed the cost of 7000*l.*,—the public works would be nothing—the supply of earth would be nothing—and the repairs ought to be almost nothing. Indeed, I know a case—the case of a school of seventy boys—in which the earth is supplied and removed by a farmer, who has agreed to give 10*s.* a month for the produce. This is little enough—still even this is a vast advantage over the water system. By the water system, again, the whole, or very nearly the whole, of this valuable source

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\* Mr. Moule writes elsewhere "The Cess-pool and Privy Vault are simply an unnatural abomination—they form so many treasure houses of bad smells and noxious gases, so many sources of disease and death, and at the same time waste the most natural and effective fertilizers of the soil." "The water closet used in connection with the Cess-pool, has only increased these evils. It affords convenience, but the evil of noxious gases is increased, and brought nearer home, and the water causing the excreta more readily to percolate the sub-soil, frequently this poisons the neighboring wells."

With the effects of the sewage and drainage of Towns and Cities in polluting the waters of their rivers, the public has of late years become painfully familiar. On this subject the Royal Commissioners on Town sewage in England arrived at the following startling conclusions.

"1st. That the increasing pollution of the Rivers and Streams of the country, is an evil of national importance which urgently demands the application of remedial measures."

"2nd. That this evil has largely increased with the growing cleanliness and internal improvement of Towns as regards water supply and drainage, that its increase will continue to be in direct proportion to such improvements." [Ed.]

of manure for our farms is thrown away and wasted. By the dry earth system the whole might be saved, and utilised to such an extent that it shall be profitable, not only to the farmers who used it, but to the towns from whence it is procured.\*

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## II.—THE PRINCIPLES OF THE DRY EARTH SYSTEM.

THESE are first, *the marvellous capability of dry and sifted earth, or of clayed subsoil, for deodorisation.* This is such, that two pounds weight of such earth, † or three half-pints, is amply sufficient for one use of a closet. And if with this quantity the excreta covered by it be intimately mixed, it may in a very short time be dried without offence by artificial heat. And the mass, when dried thus, or by natural heat, may be used again and again for the same purpose. I have tried it with success ten times.

The second principle is *in the immediate application of this deodorising power to the matter to be deodorised.* To meet this evil we must take it in detail, and we must take it at once. Little real good, if not much harm, will ever be done by traps and ventilators and gully-holes, and deodorising processes for vast volumes of sewage water. *The evil must be cut off at its source.* At this point it can be cut off, and converted into a vast benefit.

The third principle, which has only recently however been observed, and which so increases the feasibility of the introduction of this system into large towns, is this: if the deposits fall into a vault, 3 feet or 4 feet deep, the superincumbent weight of the repeated addition of two pounds of earth, and an occasional act of levelling with a rake or common scraper, are sufficient for the mixing. So that within six weeks from the deposits falling, the excreta and any vegetable matter disappear; and the mass looks and smells like fresh earth. And in that vault, without the omission of any offensive smell, it may continue three, four, or six months.

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## III.—THE APPLICATION OF THE PRINCIPLES OF THE DRY EARTH SYSTEM TO INDIVIDUAL CASES.

In the case of the ordinary privy, whether attached to a cottage or larger dwelling-house, if there be difficulty in removing it from its present site, let the present vault be emptied and cleansed, and filled

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\* The value of the manure produced annually in a City or Town is estimated at not less than £1 sterling per head for every inhabitant. The City of London, therefore, throws no less than £2,500,000 annually into the Thames, and is now expending £3,500,000 on works to throw it away more completely than before. (See Appendix D.)

† The best earth for the purpose is that containing the most organic matter. Experience in Canada has proved that black muck or swamp earth, when thoroughly dried and sifted, is admirably adapted for earth closets. Where it is difficult to obtain suitable earth in sufficient quantity, sifted ashes may be mixed with the earth, in the proportion of one of ashes to two of earth. [Ed.]



up to within three feet of the floor, and let the bottom be paved or made water-tight by cement, or by coal ashes and tar. Let there be an opening at the back for removal, as often as necessary, of the deposit of earth and soil. Let earth be collected in sufficient quantity *in dry weather*; and if there be not a covered shed to keep it in, let it be placed in a portion of the coal-hole, boarded off. Let it be sifted for use through a sieve with a mesh of one-fourth of an inch. And for a family of ordinary number, if the earth so placed be not sufficiently dry, let the requisite quantity be placed either in the oven or at night under the kitchen fire.

Simple pieces of mechanism have been invented and patented, which are set in motion either by lifting a handle as in the ordinary water closet, or by a self-acting seat. This mechanism is alike adapted to fixed closets or to commodes.\* The earth is contained in a reservoir at the back of the seat. This reservoir is furnished with a hopper, one kind of which on being lifted fills itself, and then falling by its own weight shoots the sifted earth so as to cover the deposit. In the case of the commode, there is placed beneath the seat a galvanised iron pail, which receives the deposit and the earth, and which is removed when necessary without the slightest offence. For the removal of the contents of these pails from upstairs of hospitals or sick rooms, an arrangement may easily be made of this kind: in some convenient part of the building, outside (or even inside) the walls, a shaft 12 inches in diameter may be fixed almost close to the wall, at the bottom of which should be a vault or a truck, into which through the shaft the contents might be thrown, and, if a truck were used, immediately removed. This shaft, made either of earthenware or of cast iron, glazed inside, may be used also in immediate connection with the seat of the upstairs closet, and if furnished at the lower end with a moveable bottom, will greatly facilitate the removal of the deposit, and at the same time supersede in such cases the use of the vault. It may be indeed a vault in itself. And from the space being more confined than that of the vault, the mixing and the decomposition will be more rapid. Its upper end will be almost close under the pan of the closet, and its lower end be at such a height from the ground as to admit beneath, according to circumstances, a wheelbarrow or a cart. When either of these is placed beneath, and the bottom moved or loosened, the contents of a week or a month, or two months, would fall by their own weight, and the emptying be the work of two or three minutes. This shaft may be placed within the outer walls of a house, descending into a chamber to be approached through a kind of cellar-door in the basement.

In the use of the vault as a receptacle for the contents of the closet descending through this shaft, there would, it is true, be one advantage over the shaft as itself constituting the vault. It is this, that in such cases the earth box and the hopper may be fixed at the bottom of the shaft, and the latter be worked by a wire from the

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\* For a description and plan of an earth closet. (See Appendix A.)

uppermost story of the house ; and the necessity obviated of carrying the earth upstairs. In that case two men can take out and remove the contents of a vault of a family of five persons, accumulated during six months, in less than an hour.

I must not omit to mention here the application of the DRY EARTH principle to URINALS, especially *for schools and railway stations, and other public places*.\* The contrivance is simply a pit or vault four or five feet wide, of any length required, and of that depth which will admit of easiest removal, not less than three feet. Over 12 or 18 inches of the width of this pit or vault, there is an iron grating, on which those using it stand, this grating being as wide as may be without allowing the foot to get into it. From the inner end of this grating rises an iron railing. Of course the blocking off into compartments would be the same as where water is used. It must be sheltered from rain. If the urine be thus kept from falling on stone, or slate, or wood, and fall entirely on the earth, and if this earth be well supplied, and not allowed to become very wet, all offensive smell is prevented, and a valuable manure manufactured. There are public urinals frequented by 2000 persons a day. Is it too much to say that the manure saved from them by the use of earth would be worth from 2*l.* to 3*l.* a day? A week or two ago I was requested to look at the privies and urinal of a national school of 400 children. The offensiveness was so great I could not bear to stand within ten yards of them. Now these places may, by the use of dry earth, be made perfectly inoffensive ; and I am myself disposed to estimate the value of the manure that is now wasted, but which then would be saved, at certainly not less than 5*s.* a day.

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#### IV. THE INTRODUCTION OF THE DRY EARTH SYSTEM INTO TOWNS.†

For some time after my discovery of the principles stated in a former chapter, and of their general applicability, I was quite disposed to yield to the difficulties which seemed to stand in the way of their application to towns, and to confine my attention exclusively to detached houses, and some large institutions and villages. But every year has helped to remove those difficulties. The first of these was the vast amount of earth that seemed to be requisite. But gradually we have reached this point, that for the removal of excrementitious matter alone, an average of 4 lb. a day for one person will be sufficient. This would be  $\frac{1}{2}$  a cwt. a fortnight, or for a family of five persons  $2\frac{1}{2}$  cwt. a fortnight, or 1 ton for sixteen weeks, or  $3\frac{1}{4}$  tons a year. What family thinks of the trouble of taking in so much coal every year? The removal need not be more frequent, nor would it require much more labour. But then this labour would not devolve on the family itself.

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\* For a design for Urinals and as above described see Appendix B.

† For important information as to the use of this system in gaols, see Appendix C.

In order to carry out the system in a town, a company must be formed, which will be in fact a manure company, and which will find it to its advantage to prepare and supply the earth, and remove it at least without any expense to the householders. For this company drying sheds and warehouses will be requisite, and of course a staff of men with horses and carts. Such a company has been projected for Sheffield. But at Lancaster, W. Garnett, Esq., of Quernmore Park, has undertaken an experimental work at his own risk and cost, and after three months reports most favourably of his progress.

By such a company as I have mentioned, the closets, where required, might be supplied at a moderate rent, to be paid by the householders—an arrangement which might ensure, in many cases, their better preservation. And if to the value of the manure\* arising from this source should be added that from the general cleansing of the town and of public places,—the street sweeping, the soot, the refuse of slaughter-houses, &c.,—I feel sure that from 6s. 8d. to 10s. a head would be rather too low than too high an estimate of the whole value.

But even supposing for a moment that this should be too high an estimate, and that a town council or a board of health undertaking the work should do no more than pay its expenses, the town *is cleansed for nothing, and thoroughly cleansed, instead of being heavily burdened with rates for only a very imperfect cleansing.*

HENRY MOULE, A. M.

FORDINGTON VICARAGE,

DORCHESFER, DORSET, 1866.

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\* As to the "value of the manure" see Appendix D.

## APPENDIX A.

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EXTRACT FROM A PAMPHLET PUBLISHED BY MOULE'S PATENT EARTH CLOSET COMPANY, LONDON.

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### MOULE'S PATENT EARTH CLOSETS.\*

This invention effectually remedies evils arising from common cesspool privies and water-closets; and equally prevents the offensive smell consequent on the use of the ordinary commode in Bedrooms, Hospital Wards, Prison Cells, &c.

It is founded upon the well-known power of earth as a deodorising agent : a *given quantity* of dry earth destroying all smell, and entirely preventing noxious vapours and other discomforts. The practical application of this power has been successfully carried out by the present invention, which treats all the operations *in detail*.

Apart from its superiority over the water system in destroying all smell, the earth system is more economical, both in the first cost and its after-working; there being no expensive cistern or pipes; no danger from frost; and the product being a manure of value to farmers and gardeners. The supply of the earth, and its removal, are attended with no more inconvenience than the supply of coal and the removal of ashes, whilst the value of the manure amply pays the cost. Added to which, the sifted ashes, instead of lying in the dustbin until they become a nuisance, may be mixed with the earth, and thus lessen the quantity required. Under certain conditions ashes alone may be used;—on board steamships, for instance, where they are thrown overboard daily, and where the use of the Earth Closet would not only be a great saving of cost, but the removal of an intolerable nuisance.

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### THE PRINCIPLE OF THE EARTH CLOSET

consists in an apparatus for measuring and delivering the requisite quantity of dry earth, and in a reservoir for containing it. This apparatus can be applied to most existing closets.

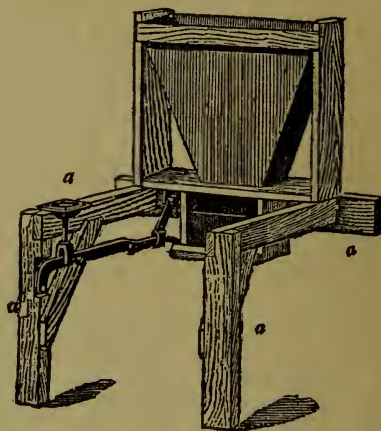
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\* These closets are manufactured at No. 29, Bedford street, Strand, London, England.



## AN ORDINARY FIXED CLOSET

requires the apparatus to be placed at the back of and in connection with the usual seat, the reservoir for containing the earth being placed above it. Under it there should be a chamber or vault, about four feet by three wide, and of any convenient depth, with a paved or asphalted bottom, and the sides lined with cement. Should there be an existing cesspool it may be altered to the above dimensions. Into this the deposit and earth fall, and may remain there three, six or twelve months, and continue perfectly inodorous and innoxious, merely requiring to be occasionally levelled by a rake or hoe. If, however, it should be found impossible or inconvenient to have a vault underneath, a movable iron trough on wheels may



be substituted. In this case it will be advisable to raise the seat somewhat above the floor, to allow the trough to be of sufficient size.

By one form of construction, (the "Pull Up,") \* the pulling up a handle releases a sufficient quantity of the dry earth, which is thrown into the pit or vault, covering the deposit, and completely preventing all smell. By another, (the "Self-Acting,") the same effect is produced by the action of the seat. The apparatus may be placed in and adapted to almost any existing closet or privy, and so arranged that the supply and removal of earth may be carried on inside or outside as desired.

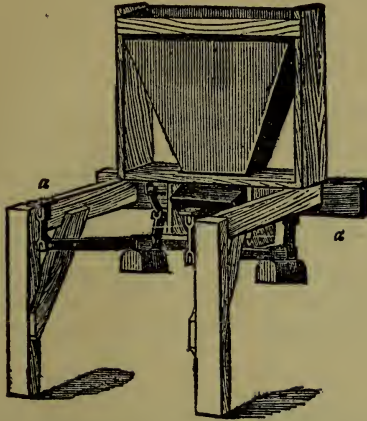
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\* The Company who manufacture the closets, state that the apparatus is adaptable to privies, either single, or in sets of one, two or six. Working plans for them or for others extended to sixteen or twenty closets are supplied by the Company.

The same Company also manufactures Earth Commodes, for use in bed-rooms and hospitals; the Commode contains in itself the apparatus and earth reservoir, and a movable pail takes the place of the chamber or vault of the ordinary earth closet. [Ed.]

It is in most cases quite easy to arrange for the closet to be placed upstairs; and for the contents of the pail to be emptied down a shaft, either inside or outside the building.

The apparatus is sold separately, and may easily be adapted or fixed by any carpenter. A drawing with instructions is sent with



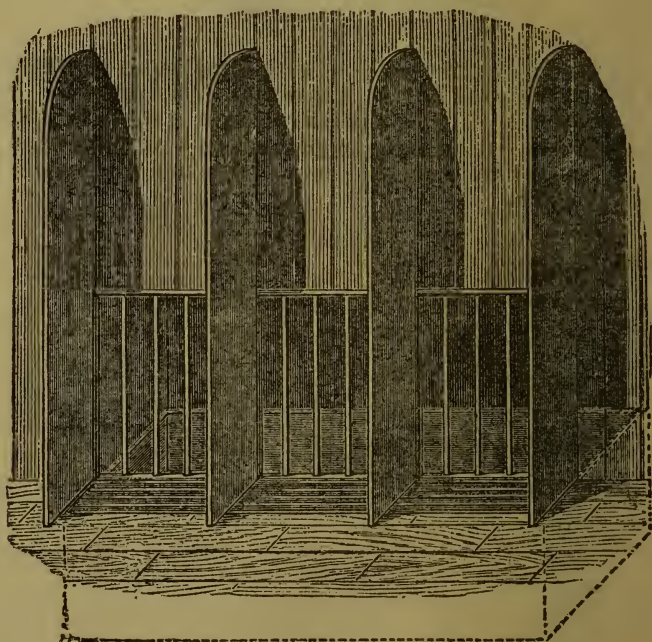
each; or, on receipt of a sketch, with dimensions of the place in which it is intended to fix the apparatus, full directions will be given for fitting it. The iron earth-reservoir is made to vibrate, so as to prevent the earth from clogging. This may be carried up, in fixing, to almost any height, so as to enable it to hold a larger quantity of earth.

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## APPENDIX B.

### URINALS.

The Dry Earth principle is equally applicable to Urinals, especially for *schools and railway stations, and other public places*. Self-acting machinery for these urinals is supplied by the Company,\* and all offensive smell may be prevented, and a valuable manure manufactured. There are public urinals frequented by 2,000 persons a day, and no one requires to be told of their offensiveness. Yet these places may, by the use of dry earth, be made perfectly inoffensive ; and the value of the manure that is now wasted, but which then would be saved, would be highly remunerative.



\* Moule's Patent Earth Closet Company, 39 Bedford street, Strand—London.



## APPENDIX C.

# DETAILS OF THE DRY EARTH SYSTEM OF SEWERAGE

(from the Rules for the Superintendence and Management of Gaols in the Lower Provinces of the Bengal Presidency, 1864.)

## *Conservancy.—Latrines and Urinals.*

As a nuisance in a gaol may easily be avoided, its existence is an indication of inefficient administration. For successful conservancy administration it is not sufficient to give an order; there must be a perfectly organized plan, with rules for the guidance of each individual, and not only must every one have his own separate duty assigned him, but in case of neglect the responsibility must be fixed upon some one against whom the neglect or want of supervision rests. It is not only necessary to give an order, but also habitually to see that it is properly carried out; and as long as there is anything to offend the senses, the officer in charge of the gaol may rest satisfied that the system is only imperfectly carried out, and no excuse should be accepted in justification.

*Drains of any description for sewage purposes within a gaol or its precincts are absolutely prohibited.*

The dry earth conservancy system shall be adopted in all gaols in substitution of any other requiring the removal of liquid sewage.

The application of not less than two pounds of dry sifted earth to the recently voided faecal or urinary excreta of one person prevents decomposition, entirely suppresses fermentation and the escape of noxious and offensive gases, and admits of the excreta being preserved in a portable and innocuous condition.

The essential conditions for the success of dry earth conservancy are :—

A. Immediate application of earth to excreta.—Unless this be attended to, fermentation and the evolution of offensive products rapidly result. The subsequent application of a large quantity of earth only abates a nuisance whose prevention is enjoined. Urine should be voided into large vessels loosely filled with dry earth.

B. The use of dry sifted earth.—If damp earth be used success cannot be expected, and if unsifted earth be employed, an unnecessarily large quantity will be required, involving extra labour in supplying fresh and in removing the soiled earth. A quantity of earth from the gaol garden should be kept constantly spread out in the sun to be thoroughly dried, and during the rainy season special arrangements will have to be made for effecting this under shelter. Before the commencement of the rains, a stock of thoroughly dried and well-sifted earth should be stored in a building for use on

occasions when it would be otherwise unprocurable. The last work every afternoon of a gang of prisoners should be to sift and carry a supply of earth, and deposit it in the earth reservoirs attached to each latrine, which should be protected from rain.

*C.* The application of a sufficient quantity of earth to the excreta.—Not less than two pounds of sun-dried and sifted earth of the most suitable kind will suffice for each use either in a latrine or urinal. The latrine receptacles having been prepared by the sweepers placing in them a layers of earth of a few inches in depth, each prisoner should be required, on each occasion of using the latrine, to throw a scoopful of earth over his evacuation.

*D.* The scrupulous avoidance of admixture of water with the sewage of the latrine.—Water used for personal ablution must be prevented from mixing with the sewage by providing large suitably shaped earthenware vessels loosely filled with earth conveniently placed to receive it. Rain water must be prevented from mixing with the sewage by having the latrines roofed over and the surface drainage in their vicinity directed away from them. All cesspools or reservoirs, and all drains or pipes, whether closed or open, leading in or out of the latrine, should be abolished as opposed to the dry system. The use of water for flushing the ground, or flooring, or vessels should be prevented, and scrubbing with dry earth enjoined for cleansing purposes. The use of lime and charcoal for these purposes is strictly prohibited, the former being worse than useless, the latter a needless expense.

The latrine building should be of the simplest description, sufficiently screened for decency's sake, but otherwise freely open to admit of perflation.

The sweepers or scavengers are to remove, morning and evening, the soiled earth from the latrines and urinals, in large baskets capable of containing 40 to 50 pounds, and deposit it in previously prepared shallow trenches, about a foot in depth, in the gaol garden. These trenches must always be kept ready for the deposit of sewage, cook room and garden refuse, and gaol sweepings.

Immediately the sewage has been disposed of as directed, which should at all seasons be completed before 7 o'clock a. m., and 6 o'clock p. m., the trenches should be filled up with earth, a layer of from six to nine inches being sufficient, provided that the sewage was previously in a suitable condition to be carried in twig baskets, and to ensure this the supply of all vessels suitable for liquid sewages should be withheld.

At gaols where the deodorised ordure is more than is needed for or can be disposed of in the garden, it is to be covered over with earth in trenches made for the purpose, at a distance from the gaol, but far apart from wells and tanks used for drinking or culinary purposes.

*Night Privies.*

Every sleeping ward shall be provided with at least three vessels, viz., a urinal, an earth closet, and an earth reservoir with wooden scoop.

The urinal, loosely filled with dry earth, is only to be used for the reception of urine. Not less than one maund or eighty pounds of dry earth is to be allowed for forty uses. If urine appear on the surface in the morning it is an indication of insufficiency of earth in the vessel. It is an essential condition for success that the earth should absorb all the urine.

The earth closet is any suitable vessel containing a layer of dry earth into which the inmates of a sleeping ward or hospital can defæcate, a scoopful of earth from the earth reservoir being immediately thrown over the recently voided excreta. Every prisoner is to be made to throw at least one seer or two pounds over his excreta immediately after using the earth closet. The earth closet is to be solely for the purpose it is intended for; if used as an urinal failure will result, for it is an essential condition of success that the earth applied to the fæces shall be capable of absorbing their moisture, which damp earth can do imperfectly and wet earth not at all. Ablution should be performed over the urinal.

To prevent nuisances around the urinal and earth closet a night light is to be kept burning in their immediate neighbourhood.

At 3 o'clock p. m. the night vessels shall be put in their proper places in every sleeping ward, and care shall be taken that they are placed on, and surrounded by, a thick layer of dry sifted earth, to protect the floor from being accidentally soiled by excreta. If any effluvium remain after the removal of the night vessels and the earth it is a sure sign that there has not been a sufficiency of the latter.

Immediately after the prisoners vacate the sleeping wards in the morning, the vessels used as night urinals and earth closets shall be removed to the garden, their content disposed of in the manner prescribed for sewage generally, and the vessels themselves thoroughly cleaned and scrubbed with dry earth and exposed to the sun until replaced at three o'clock p. m. for night use, when the urinals should be filled with dry sifted earth, and the earth closets furnished with a thick layer of it.

(Note.) The Inspector General of Prisons in Bengal states that the dry earth system works successfully. He adds two cautions derived from experience in the Bengal prisons, viz., (i) that the earth used must not be clay, and should contain much organic matter; (ii) that if less than the prescribed quantity of earth is used, or if earth once used is used again without having been sufficiently dried, or if too much of the saturated earth is used in grounds adjoining the prison, there is much danger of disease.

The Editor thinks it well to state that the preceding details are copied from the Digest and Summary of information respecting Prisons in the Colonies, presented to the British Parliament in 1867.

In the summary there given of the principal conclusions arrived at in the *construction* of Prisons the document from which these details are taken states under the head "Construction" :

"Details of the « Dry Earth system » in the place of liquid sewerage « are given in the Appendix. This system is in use in all the Prisons « of India, some of them containing as many as 2,000 prisoners, and « in the Hulsdorp prison at Colombo in Ceylon. The Inspector General of Prisons in Bengal states that, when proper care is taken, « this system is perfectly successful and is inexpensive."

Up to the present time the sewage question has been not only the *opprobrium* and bug-bear of Sanitary Reformers generally, but the especial *bête noire* of Prison Architects and Prison Inspectors. To all who have any thing to do with Gaols whether as Inmates or Inspectors, the present discovery cannot fail to prove an inestimable blessing, a wonderful saving of health, money and temper.

The subjoined letter from one of our most experienced Jail Architects in Canada, is to the purpose :

« Ottawa, 23rd October, 1868.

« E. A. MEREDITH, Esquire,

« Under Secretary.

« Sir,

« I have perused with interest the pamphlets on Earth Closets « you were kind enough to send me; the system in my opinion « has only to become known to be adopted in our Prisons, Asylums « and other Institutions. Having as Architect erected several Jails « in Ontario, I can state that water closets in them are found to be « a source of great annoyance and expense, so much so indeed that « of late they have been omitted in these buildings altogether. « I am glad to see that in the dry earth system you propose to « introduce the difficulties connected with Water Closets do not « exist and (to say nothing of the value of the soil as a manure) « much expense will be saved by the simplicity of its working. « I expect to see it generally adopted.

« I have the honor to be,

« Sir,

« Your obedient servant,

« H. H. HORSEY,

« Architect. »



## APPENDIX D.

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EXTRACT FROM A PAMPHLET PUBLISHED BY MOULE'S PATENT EARTH CLOSET COMPANY.

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## VALUE OF THE MANURES.

If the closet is over a water-tight cesspool or pit, it will require emptying at the end of three or six months. The produce, which will be quite inodorous, should be thrown together in a heap, sheltered from wet, and occasionally turned over. At the end of a few weeks it will be dry and fit for use.

If the receptacle be an iron trough or pail, the contents should be thrown together, re-dried, and used over again four or five times (see page 11). In a few weeks they will be dry and fit for use; the value being increased by repeated action. The condition of the manure should be much the same as that of guano, and fit for drilling.

With regard to the money value of the manures, Mr. James, of Halton, has furnished us with the following particulars. He says.—

« Mr. J. Gadsden, who holds upwards of 600 acres of land in this and an adjoining parish, has applied earth passed once through the closet to a turnip crop, and has produced some of the finest roots I ever saw, although it was sowed broadcast, and not as it should have been, by the drill. He has no hesitation at all in estimating its minimum value at £3 per ton.

« Mr. Gamble, who holds land here to the same extent, has arrived, by an independent trial and calculation, at the same conclusion.»

Mr. Henry Taylor, Manufacturer of Agricultural Implements, at Dorchester, who is also a Manure Dealer, and holds a small farm, supplies the earth for the closets and urinals of the Dorset County School. The contents of the vault are removed by him once in three months. He has tried the manure so manufactured on various crops, and he has informed us that he considers the deposit of three months, after one use of the earth, to be worth, when dry, from £2 to £3 per ton. He has tried the repeated use of the same earth, and he considers the value of the manure to increase in proportion to the number of uses.

With regard to its practical value, the following facts may be relied on :—

To a quarter of an acre of Swede turnips, one hundredweight of earth manure, which had been used five times, was applied. To three-quarters of the same acre, superphosphate (at that time worth £7 10s. per ton) was used in the same proportion. On the quarter

of an acre dressed with earth manure, the turnips weighed one-third more than those grown on the three-quarters of an acre. The whole crop was fed off; no other manure was used; and the following year the barley crop was finer on the quarter of an acre, in the proportion of four to three.

The following year, on another piece of land, earth which had passed seven times through an earth-closet, was substituted for crushed bones, at the rate of one cwt. per acre. The ground was poor, the crop white turnips, and several good judges expressed the opinion that a finer crop could scarcely have been grown. Mr. Dickinson, of New Park Farm, Hampshire, has asserted that such a mixture is equal to crushed bones in power, more immediate in its action, and that the benefit lasts three years in the ground.

In a garden near Erith, belonging to the Rev. H. Bernau, Belvedere, (about half an acre,) for twelve or fourteen years an annual manuring of stable dung had failed to produce anything like a crop. Peas would not grow. Cabbages were dwarfed. Neither celery nor rhubarb nor parsnips would grow at all. Last year, as an experiment, the stable dung was abandoned, and earth from a closet used.

The first sowing of peas was destroyed by a too liberal use. Grown wiser by experience, the gardener used less, and his barren garden was changed into a fruitful field. His peas grew seven feet high, and were covered with pods; the white head of his cabbages weighed four pounds and upwards, and the passers-by stopped with wonder to ask what made his crops so much better than their own.

At the West Riding prison, a piece of ground was last year sown with onions, in the usual way; the produce being *nil*. This year the same ground was dressed with earth manure, and again sown with onions. Twice again dressed whilst growing, the result has been a very fine crop. At the same place, one half of an acre of grass land was manured with rotten dung, valued at 48s. The other half acre was manured with half a ton of earth manure. The crops were both fine and equal in value.

If the manure be not drilled in, care should be taken to use it during rainy weather; otherwise, the valuable salts contained in it remain undissolved.

It is believed, on the ground of much observation and experiment, that as soon as the earth covers the deposit, some manurial property of that deposit begins to impregnate it; and that when the deposit is wholly absorbed, the earth has in fact digested it, or reduced it to a form or state in which it can afford nourishment to the plant. The sooner, therefore, the root can reach it the better.





